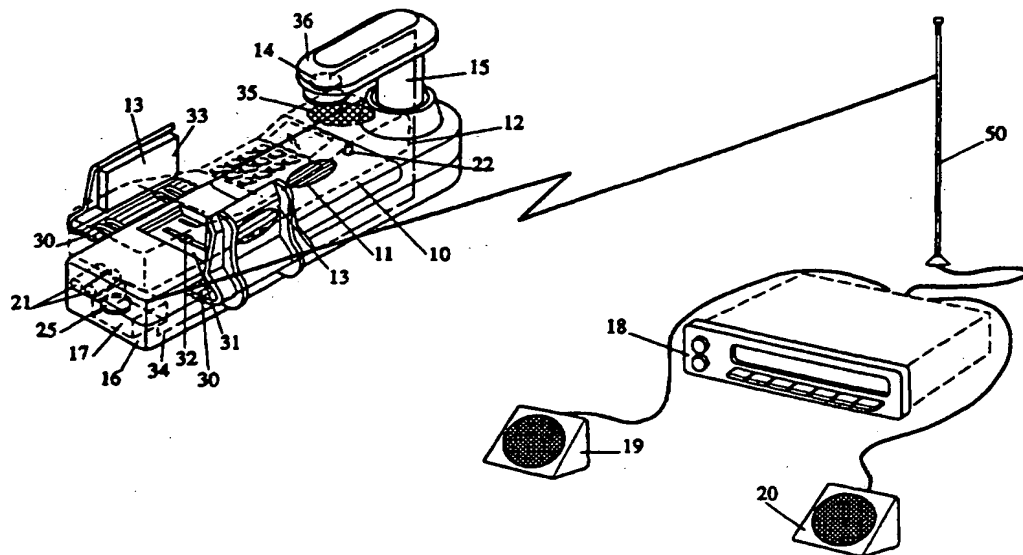




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(54) Title: **A HANDS FREE MOBILE PHONE UNIT**

(57) Abstract

The present invention relates to an improved device that will enable cordless or mobile telephones to be used in a hands free manner in vehicles or any other situation, the device comprising a transmitter device tunable to desired channel frequencies of an existing sound reproduction system such as a vehicle radio, the transmitter device being mounted in the mobile phone itself or being associated with a structure to hold the mobile phone whereby sounds received by said mobile phone associated with an incoming call are transferred to said transmitter device to be transmitted therefrom to the sound reproduction system to be reproduced thereby.

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A HANDS FREE MOBILE PHONE UNIT

The present invention relates to an improved device that will enable cordless or mobile telephones to be used in a hands free manner in vehicles or alternatively that will allow modification of a cordless or mobile telephone for
5 use in a hands free manner within a vehicle.

Currently there is a considerable expansion of the general use of mobile telephones and these telephones often are used in vehicles. There is therefore a need for some means to use such telephones in a hands free fashion so that the vehicle can be operated safely while at the same time the driver can either
10 make or receive telephone calls. So called hands free telephone systems are currently available but they are complicated and expensive as they are normally integrated systems and normally are applicable to one particular type of mobile telephone. There is a need to have an effective hands free system that is low cost and easily installed so that generally all owners of mobile telephones can
15 afford to and would be willing to acquire and install the system in their vehicle or perhaps in any other application where a hands free facility would be of advantage. It would of course also be desirable for the system to be operable with most if not all currently available mobile phones. In the alternative, it would be desirable to provide a low cost modification to a mobile telephone itself so
20 that it could be used in a hands free manner within a vehicle or any other application. Accordingly, it is the objective of the present invention to achieve the foregoing desired products.

Accordingly, in one preferred aspect, the present invention provides a hands free mobile telephone arrangement adapted for use with an existing
25 sound reproduction system including a radio or the like, said arrangement comprising support means to hold a mobile telephone in a predetermined position whereby a sound delivery section of the mobile telephone is positionable adjacent to a sound receiving means of said arrangement, said sound receiving means being coupled to a transmitter device for transmitting a
30 signal indicative of sounds from said sound delivery section of the mobile telephone received from said sound receiving means to the sound reproduction system to be reproduced thereby. Conveniently the arrangement is provided

with a suitable operational power source. The power source may comprise a battery which may, if desired, be rechargeable. In one preferred application, the arrangement is adapted to be mounted in a vehicle in a location adjacent the vehicle driver. In such an application, the arrangement might advantageously
5 be connected to the vehicle electrical system to provide the necessary power to drive the arrangement. In other applications, the arrangement might be used in the home or in office environments so long as an existing sound reproduction (radio) system exists.

The arrangement provided by the foregoing system comprises simple
10 inexpensive elements that can be manufactured cheaply and can be readily installed without any need for expertise. The use of the existing vehicle radio or some other existing radio means that a very effective and inexpensive hands free arrangement can be achieved. It has been found that if a driver wishes to make an outgoing call, the existing microphone in mobile telephones is
15 sufficiently good for the phone to work satisfactorily even though it may not be positioned near to the user's mouth. Thus, when the phone is held in its predetermined position, the operator simply needs to dial a desired number to make the connection and thereafter talk normally. For incoming calls, the incoming sounds are reproduced and amplified through the vehicle radio
20 system and again outgoing transmissions are achieved conventionally through the mobile telephone.

In accordance with a second aspect, there is provided a hands free mobile telephone arrangement adapted for use with a sound reproduction system and a mobile telephone including a sound delivery section for producing
25 acoustic waves, including:

- a support means for receiving the mobile telephone;
- transducer for converting the acoustic waves to an output electric signal;
- a wireless transmitter device coupled to the transducer for receiving the output electric signal and for transmitting a signal indicative of the acoustic
30 waves for reception by the sound reproduction system; and

an acoustic wave guide having a first portion positionable adjacent to the sound receiving means of the mobile telephone when the mobile telephone is supported by the support means and a second portion arranged adjacent the transducer for guiding the acoustic sound waves from the sound receiving
5 means of the mobile telephone to the transducer.

In accordance with a third aspect of the present invention there is provided a mobile telephone adapted for use in a hands free manner with a sound reproduction system including a radio or the like, said mobile telephone including a transmitting device coupled to a sound receiving means of said
10 mobile telephone, said transmitter device, when activated, being adapted to transmit a signal indicative of sounds received by said sound receiving means to the sound reproduction system to be reproduced thereby.

Conveniently, in both the foregoing aspects, the mobile telephone or the arrangement includes a tuning control means to tune the transmitting device to a
15 desired channel of the radio included in the sound reproduction system. In one possible arrangement, the transmitting device might be tunable over the entire local FM band. With this embodiment, the radio receiver is preset to the desired reception frequency and the transmitting device is tuned to that reception frequency. In another possible arrangement, the transmitting device might be
20 tunable over a small range around a nominal centre frequency within the local FM band. With this embodiment, the radio receiver is tuned to the transmitting device frequency. Fine tuning of the transmitting device allows the transmitting device Tx frequency to be shifted off strong local interfering signals.

Several preferred embodiments of the present invention will hereinafter
25 be described with reference to the accompanying drawings, in which :-

Figure 1 is a schematic perspective view of one preferred embodiment;

Figure 2 is a schematic perspective view of a second possible modified embodiment of the present invention;

Figure 3 is a block circuit diagram of a first preferred embodiment
30 showing one preferred manner of performing the present invention;

Figures 4 and 5 are block circuit diagrams of second and third embodiments showing further preferred arrangements for performing the present invention.

Referring to the drawings, one preferred arrangement comprises a support structure 10 which is adapted via fastening means such as velcro or double sided adhesive tape to be mounted within a vehicle somewhere in the general vicinity of the vehicle driver. The support structure 10 includes a releasable fastening means 11 such as velcro so as to retain a mobile telephone 12 in a predetermined position as shown. If desired, adjustable side support bars 13 may also be provided. The support bars 13 may either be in a fixed position generally slightly greater than the width of most commonly used mobile phones or alternatively they may be individually adjustable inwardly or outwardly as shown in the drawings annexed hereto. This adjustment might be achieved by means of providing a series of serrations or grooves on the horizontal section 30 of the support bars 13 which are co-operable with similarly configured serrations or grooves on a plate 31 which can be urged downwardly by a screw 32 to selectably position the support bars 13 in any desired position. The upright sections of the support bars 13 conveniently have inwardly facing resilient pads 33.

At one end of the support structure 10, sound receiving means 36 is provided in the form of a microphone 14 on an upstanding support stand 15 so that, with the mobile phone 12 in position, the microphone 14 is positioned over the sound delivery section 35 (ear piece) of the mobile phone 12. Conveniently, the stand 15 might be made adjustable for differing sized mobile telephones. The support structure 10 may also include a housing section 16 adapted to mount a control arrangement 17 which includes a transmitter device 41, 44, 46 (Figures 3 to 5) which is appropriately connected via a connection means 34 to the microphone 14 to receive and transmit signals indicative of sounds received by the mobile telephone during a telephone transmission. The connection means 34 may be an electrical coupling between the microphone 14 and the transmitter 17 but when used, particularly with digital phones, it is desirable to shield the connection means from the mobile telephone without of course

obstructing the transmitter. In another preferred embodiment, the connection means 34 may be a mechanical coupling comprised of a sound transmitting tube which transmits sound from the sound receiving means 36 to the control management 17. The transmitter device is conveniently either an AM or FM
5 transmitter tuned via a tuning control 25 to be received by a selected channel of the car radio shown schematically at 18 which includes an aerial 50. Various control and tuning arrangements are discussed in following paragraphs. The radio 18 is conveniently installed in the vehicle and would otherwise be adapted to receive and disperse normal radio programming via conventional speakers
10 19, 20 installed as part of the radio system within the vehicle. The housing section 16 may, as desired, include appropriate batteries 21 to power the hands free system or alternatively, the system might be powered by any other convenient means including connection to the vehicle electrical system. The batteries 21 may be of the rechargeable type if desired.

15 The device 10 according to the present invention may include any one of a number of methods to turn the device on or off, however, it will be recognised that this capability might not be needed if the device is connected to an external power source such as a vehicle electrical system rather than using batteries in the device itself. It is of course possible to include a simple on/off switch that
20 would be manually operated by the user. Another preferred method of achieving this aspect might be to include a switch 22 activated by positioning of the mobile telephone 12 so as to activate the power supply to the control arrangement 17. When the phone is removed, the switch 22 automatically deactivates the power supply to protect the system and save the batteries when
25 the supply is from batteries. Other possible methods might include optical sensing whether a mobile telephone is in place or not and switching in response thereto and similarly, magnetic proximity switching dependent on whether a mobile telephone is in place or not. All the aforesaid methods depending on the operational positioning of the mobile telephone 12 do have
30 the disadvantage that the device will be activated when the phone is positioned regardless of whether the phone is in use or not. A still further method might be to use sound actuation techniques such as "received voice" or "keypad tones"

from the mobile telephone to activate the device. This arrangement desirably provides for the transmitting device to be activated for a predetermined time after the detection of a voice or tone from the mobile telephone held operationally in the device. A still further possible method might be to utilise RF detection. The
5 device might, in this arrangement, be activated by the detection of an "in-call" RF field from the active mobile telephone held operationally in the device. The device would then be deactivated as the mobile call ends, i.e. as the RF field disappears.

In a further possible arrangement, it will be appreciated that the housing
10 section 16 does not need to be integrally formed with the remainder of the apparatus and the control arrangement 17 and power supply can be separately located with appropriate electrical connections.

Figure 3 illustrates in block diagram format, one preferred control arrangement for use with the present invention. The power supply comprises
15 battery means 21 providing a voltage regulated DC power supply via voltage regulator 37 to microprocessor 38 and to an audio amplifier 39. The microprocessor 39 provides temperature compensation and tuning functions and the audio amplifier 39 provides mixing and level detection functions. In this arrangement, the audio amplifier 39 amplifies any signals from the microphone
20 14 (for example indicative of a call being received or a call being made) and provides a start signal to the microprocessor 38 provided the audio signal is above a required level. Upon this signal being received, a tuner 40 is commenced within the microprocessor 38 which after a preset period will automatically turn the system off. As an alternative, activation of the system may
25 be as aforesaid but with the system being turned off by operation of a manual switch. This will allow calls of any length duration to occur and the manual turn off of the system might be aided by issuance of a periodic beeper noise. Commencement of the system applies power to a voltage controlled oscillator (VCO) 41 which, when powered radiates in the FM band to transmit a required
30 signal to the vehicle radio system. The VCO 41 is modulated by the AF signal from the microphone 14 via the audio amplifier 39 and is tuned by the DC temperature compensation and the fine tune signals from the tuner 25. The

microprocessor 38 reads the VCO case temperature via a temperature sensor 42 and applies temperature compensation or connection volts to the AF mixer of the audio amplifier 39.

It is generally perceived to be desirable to provide a means for stabilising transmission frequency of the control arrangement 17 with temperature and supply voltage variations. One method of achieving this is described above with reference to Figure 3. Another method of achieving this would be to utilise a crystal locked synthesiser which relies on the inherent temperature stability of a crystal oscillator. The disadvantage of this possibility is that it is relatively expensive. The supply voltage regulator 37 stabilises the VCO supply voltage. A still further possibility is to utilise an internally compensated VCO 41' as shown in Figure 4. This requires a custom built VCO with internal components to provide output frequency stability over the temperature and supply voltage range.

Figure 5 illustrates a still further possible control circuit that is activated by sensing an RF field existing when the mobile phone is activated with either an incoming or an outgoing call. In this arrangement an RF field detector 43 is provided to activate or deactivate a switching means 44 providing a power supply to a voltage regulator 37 which, while the switching means 44 is activated, provides a regulated stable power supply to the system. The power supply is provided to the audio amplifier 39 and to an RF parts XTAL locked FM transmitter 44 which, when powered, radiates in the FM band modulated by AF microphone signal amplified by the amplifier 39. FM channel selection may be via a DIP switch 45.

Referring now to Figure 2, a mobile phone 23 is shown which may be generally conventional except that it includes a control arrangement 17' including a transmitter device adapted to receive sound signals from the sound delivery section 24 of the phone and transmit same to the vehicle radio as with the embodiment of Figure 1. The control arrangement 17' may be controlled and tuned as discussed above for the embodiment of Figure 1 with particular reference to Figures 3, 4 and 5 but in one arrangement may be tuned to a desired channel by a control 25' and may be powered by the phone battery

system or might include its own battery power supply. Any other suitable power source could be utilized. For convenience sake, the mobile phone 23 might also include releasable fastening means, such as velcro, for locating the phone in a convenient use position adjacent to the vehicle driver.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A hands free mobile telephone arrangement adapted for use with an existing sound reproduction system including a radio or the like, said arrangement comprising support means to hold a mobile telephone in a predetermined position whereby a sound delivery section of the mobile telephone is positionable adjacent to a sound receiving means of said arrangement, said sound receiving means being coupled to a transmitter device for transmitting a signal indicative of sounds from said sound delivery section of the mobile telephone received from said sound receiving means to the sound reproduction system to be reproduced thereby.
2. A hands free mobile telephone arrangement according to Claim 1, further including power supply means adapted to supply power to said transmitter device.
3. A hands free mobile telephone arrangement according to Claim 1 or Claim 2, wherein said sound receiving means includes a microphone and audio amplifying means.
4. A hands free mobile telephone arrangement according to Claim 2 or Claim 3 when appended to Claim 2, wherein voltage regulation means is provided to stabilise supply voltage provided by said power supply means.
5. A hands free mobile telephone control arrangement according to Claim 4, wherein transmission frequency of said transmitter device is stabilised relative to operational temperature variations.
6. A hands free mobile telephone control arrangement according to Claim 5, wherein said transmitter device includes a voltage controlled oscillator.

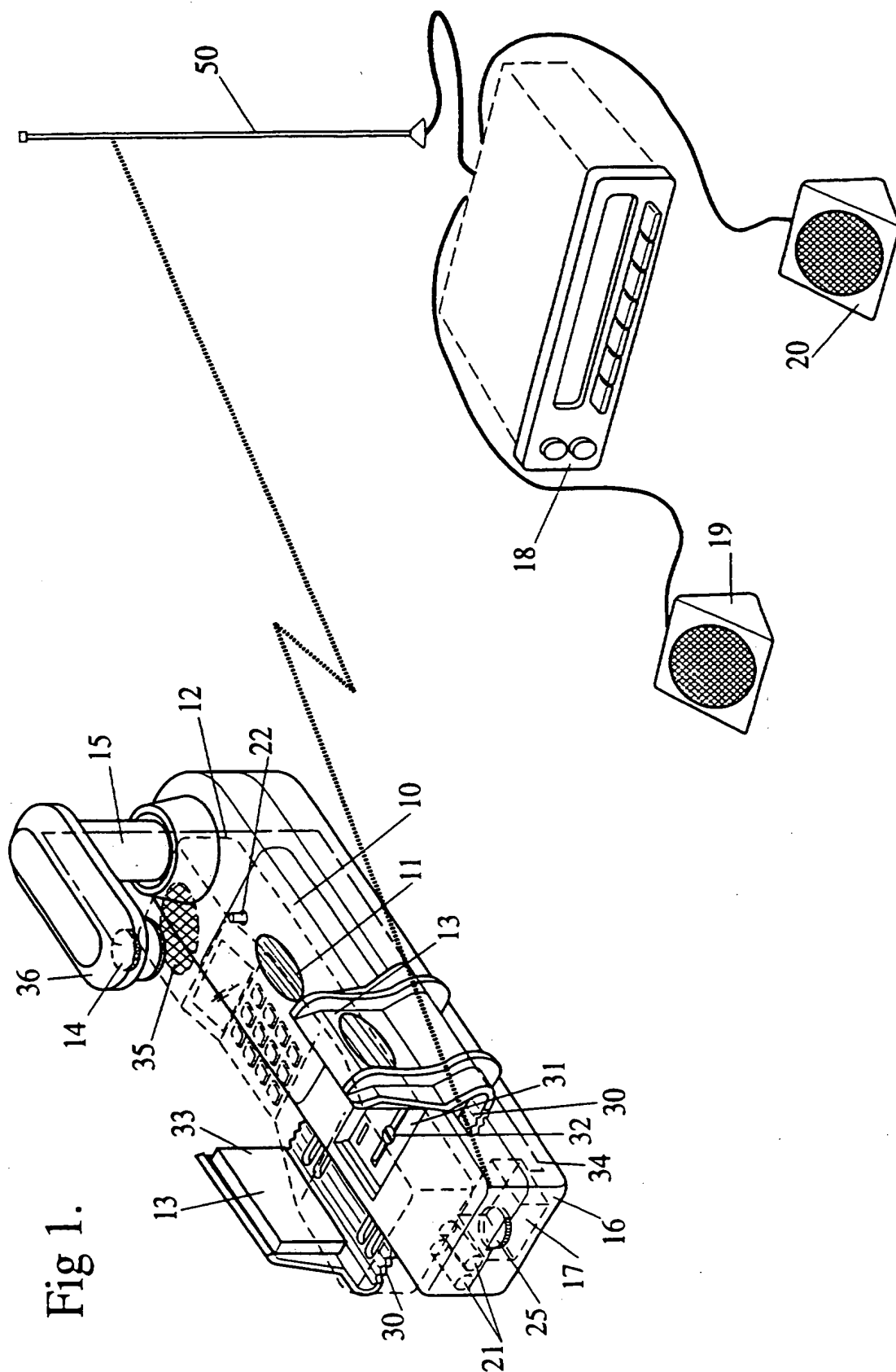
7. A hands free mobile telephone control arrangement according to Claim 6, wherein said voltage controlled oscillator is internally compensated for temperature variations.
8. A hands free mobile telephone control arrangement according to Claim 6, wherein said transmitter device also includes a microprocessor receiving temperature indicative signals from a temperature sensor associated with said voltage controlled oscillator.
9. A mobile telephone adapted for use in a hands free manner with an existing sound reproduction system including a radio or the like, said mobile telephone including a transmitting device coupled to a sound receiving means of said mobile telephone, said transmitter device, when activated, being adapted to transmit a signal indicative of sounds received by said sound receiving means to the sound reproduction system to be reproduced thereby.
10. A hands free mobile telephone control arrangement or a mobile telephone according to Claim 1 or Claim 9 respectively, further including tuning control means to tune the transmitter device to a desired channel frequency or frequencies of the sound reproduction system.
11. A hands free mobile telephone arrangement adapted for use with a sound reproduction system and a mobile telephone including a sound delivery section for producing acoustic waves, including:
 - a support means for receiving the mobile telephone;
 - transducer for converting the acoustic waves to an output electric signal;
 - a wireless transmitter device coupled to the transducer for receiving the output electric signal and for transmitting a signal indicative of the acoustic waves for reception by the sound reproduction system; and

an acoustic wave guide having a first portion positionable adjacent to the sound receiving means of the mobile telephone when the mobile telephone is supported by the support means and a second portion arranged adjacent the transducer for guiding the acoustic sound waves from the sound receiving means of the mobile telephone to the transducer.

12. The hands free mobile telephone arrangement according to claim 11 wherein the acoustic wave guide comprises a hollow tube.

13. The hands free mobile telephone arrangement according to claim 11 or claim 12 wherein the transducer comprises a microphone.

1/5



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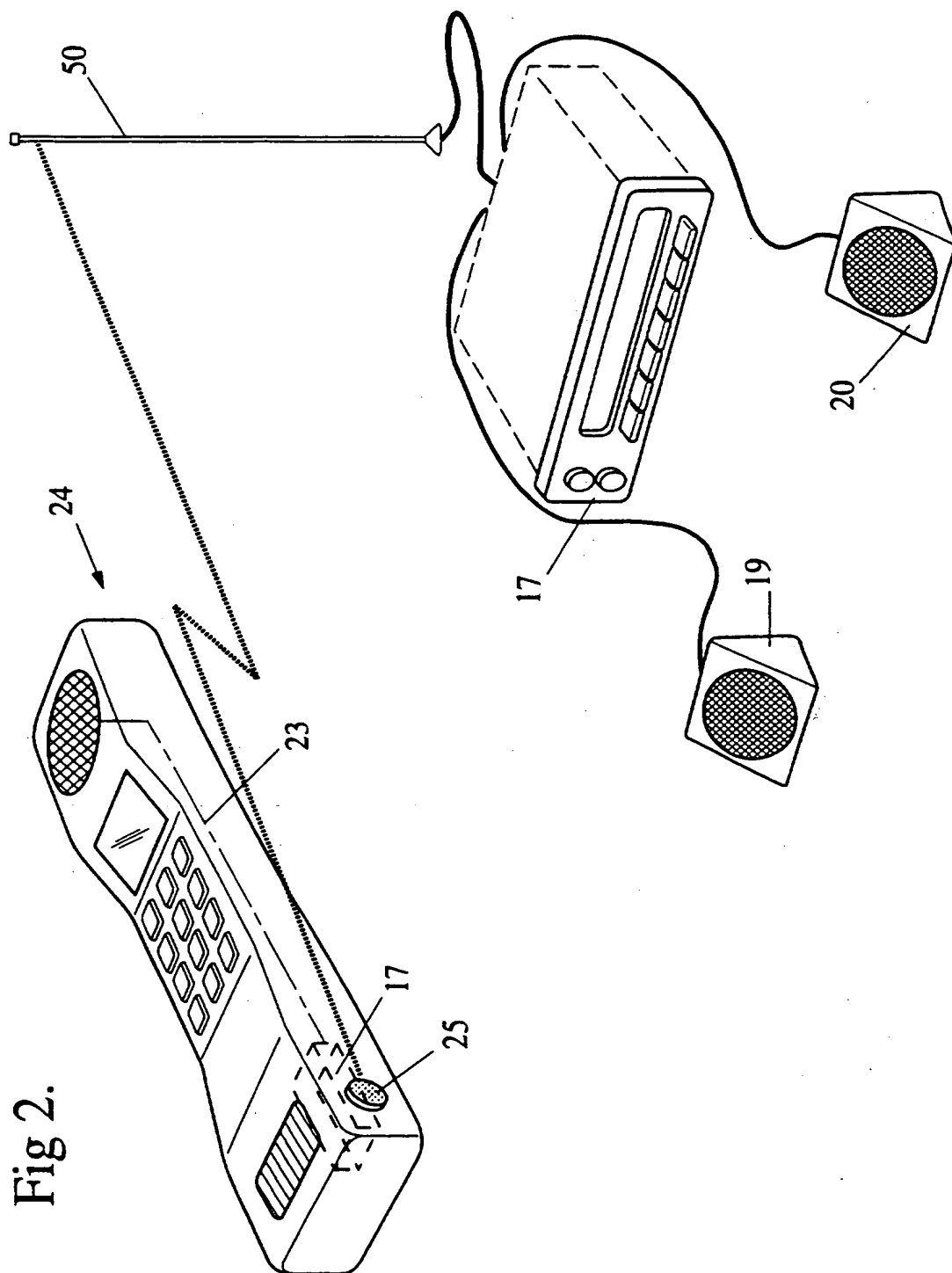


Fig 3

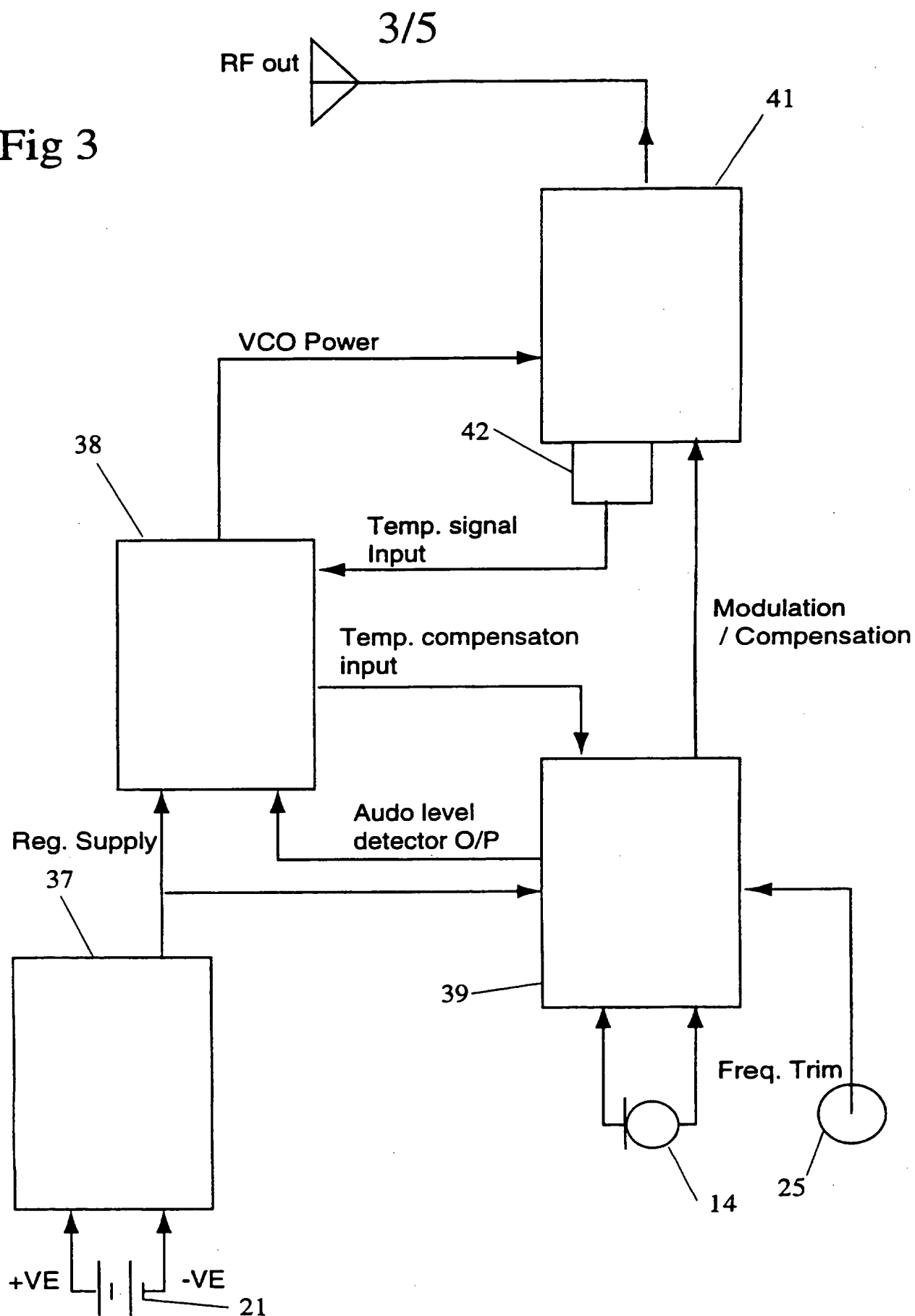


Fig 4

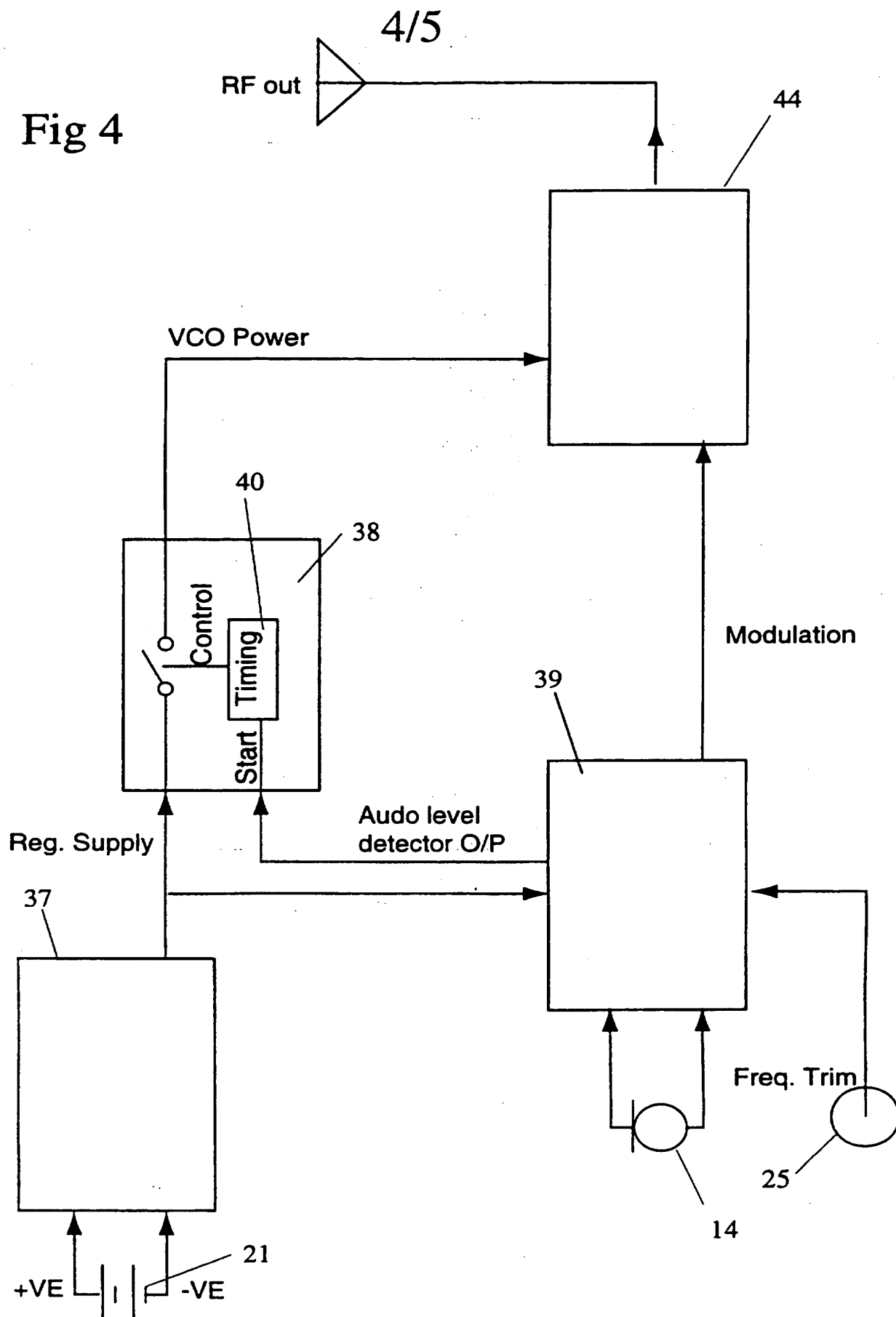
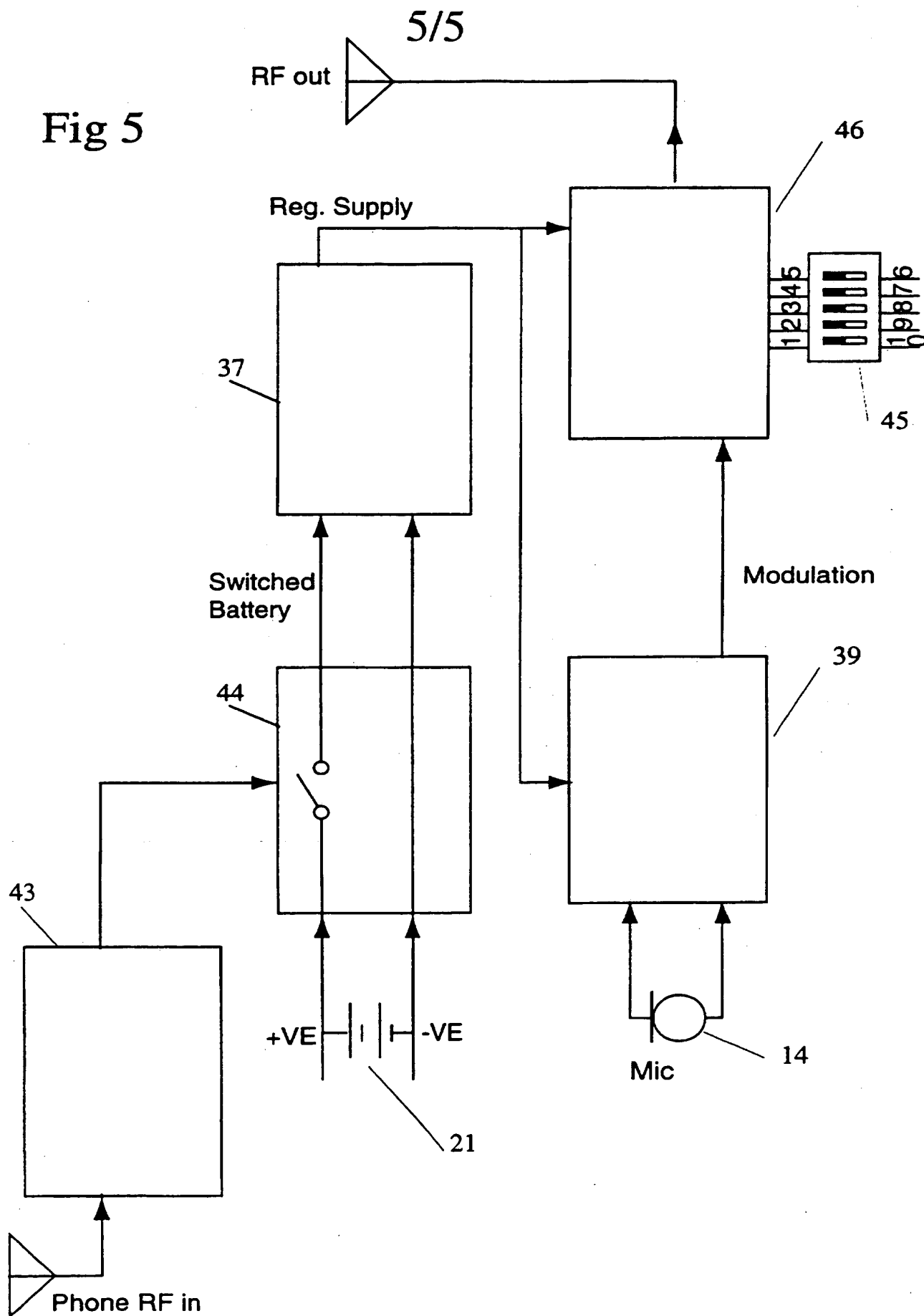


Fig 5



INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00599

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁶: H04B 5/06 7/26; H04M 1/04 1/21; H04Q 7/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC H04B 5/06 7/26; H04M 1/04 1/21; H04Q 7/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DERWENT; JAPIO: HAND FREE: TRANSDUCER: MICHROPHON:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of Box C

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L. International Application No.

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C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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